SCIENCE EXPLAINER / 01

What is bioelectric protein expression therapy?

Using electrical signals to influence the biological instructions inside living cells.

The body communicates electrically

Cells respond to electrical and chemical cues. Bioelectric protein expression therapy is an investigational approach that applies selected electrical signals to influence how cells produce or release proteins involved in repair, blood-vessel formation and tissue function. [1,2]

1 Apply a signal

Electrodes deliver a defined electrical waveform.

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2 Activate pathways

Cell signaling can influence gene activity.

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3 Measure output

Test protein production and biological effects.

How does a signal change a protein?

Electrical stimulation can affect membrane voltage, ion movement and intracellular signaling. Those pathways can alter transcription - the process of reading a gene - and downstream protein production. The response depends on the cell type, waveform, dose and tissue environment. [1,2]

An example: VEGF

Laboratory studies show that electrical stimulation can increase expression of vascular endothelial growth factor (VEGF), a protein involved in blood-vessel growth. This supports the mechanism; it does not establish that every signal controls every protein or regenerates an organ. [1,2]

From electrical signals to regenerative research

Protein targets	VEGF for vascular support; Klotho and other repair-related proteins are targets of Lionheart research.
Delivery systems	External electrodes, wearable stimulation and implantable microstimulators can provide different tissue exposures.
Potential applications	Research spans muscle, neural, vascular and organ-support biology. Each application needs its own evidence.

Lionheart’s platform approach

Lionheart is developing combinations of programmable stimulation, regenerative cells and biological delivery. Its proposed KlothoPatch™ II platform includes electrodes alongside Klotho-expressing cells and a hydrogel matrix. [3]

What demonstrates success?

Studies must connect a reproducible signal to a measured protein change, and then to meaningful functional benefit. Controlled comparisons help separate stimulation effects from exercise, cell therapy and other components. Device clearance for an existing use does not establish efficacy for a new protein-expression indication.

SELECTED SOURCES

1. Electrical stimulation directly induces pre-angiogenic responses in vascular endothelial cells (2004). [Read source]

2. DC electric stimulation upregulates angiogenic factors in endothelial cells (2011). [Read source]

3. Lionheart Health: proposed KlothoPatch II platform (September 22, 2026). [Read source]